

Radiation from accelerated particles in shocks and reconnections

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Plasma instabilities are responsible not only for the onset and mediation of collisionless shocks but also for the associated acceleration of particles. We have investigated particle acceleration and shock structure associated with an unmagnetized relativistic electron-positron jet propagating into an unmagnetized electron-positron plasma. Cold jet electrons are thermalized and slowed while the ambient electrons are swept up to create a partially developed hydrodynamic-like shock structure. In the leading shock, electron density increases by a factor of about 3.5 in the simulation frame. Strong electromagnetic fields are generated in the trailing shock and provide an emission site. These magnetic fields contribute to the electrons transverse deflection and, more generally, relativistic acceleration behind the shock. We have calculated, self-consistently, the radiation from electrons accelerated in the turbulent magnetic fields. We found that the synthetic spectra depend on the Lorentz factor of the jet, its thermal temperature and strength of the generated magnetic fields. We are currently investigating the specific case of a jet colliding with an anti-parallel magnetized ambient medium. The properties of the radiation may be important for understanding the complex time evolution and/or spectral structure in gamma-ray bursts, relativistic jets in general, and supernova remnants.